

# Current Capture

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## Abstract

Current Capture aimed to design, develop, and test a prototype of a hydropower turbine that is scalable and deployable. The design considers the harsh ocean environment, corrosion in the material selection, efficiency in the blade choice, and structural positioning in the housing extremities. Two NACA foil composite blades were designed and manufactured to perform an experiment and analyze the velocities and RPMs.

## Objectives

1. Design and manufacture a towable hydrokinetic turbine prototype
2. Test to identify the best NACA foil for harnessing current energy

## Impacts

This multi-faceted project provides a proof of concept for advancement in the marine energy sector, specifically for deployment from a stationary marine vessel along the current of the Gulf Stream. The turbine presents an innovative system to help reduce the maritime industry's carbon footprint and create profitable green energy by collecting current energy to provide to hydrogen generators or battery storage. Power generation with no fuel input allows for an environmentally responsible way of offsetting emissions and reducing expenses in maritime operations.

## Acknowledgements

We would like to thank the Ocean Engineering and Marine Sciences department for the opportunity to expand our education. Our project would not have been possible without the support from the following people: Stephen Wood, Jolie Elliott, Tessa Mati, Stephen Coster, Ronnal Reichard, Ceana Palacio, Robert Weaver, Sarah Irizarry, and Ben Klimczak.

## System Design

### Subsystem's Goals:

1. Float: Position system in appropriate orientation and evenly distribute buoyancy forces
2. System Housing: Barrier between outside sources and blades, contain attachment point for float and towing device
3. Blades: Hydrodynamic shape and robust for underwater use
4. Gear Box and Direct Drive: Contain motor and connection point for blades, and electric system

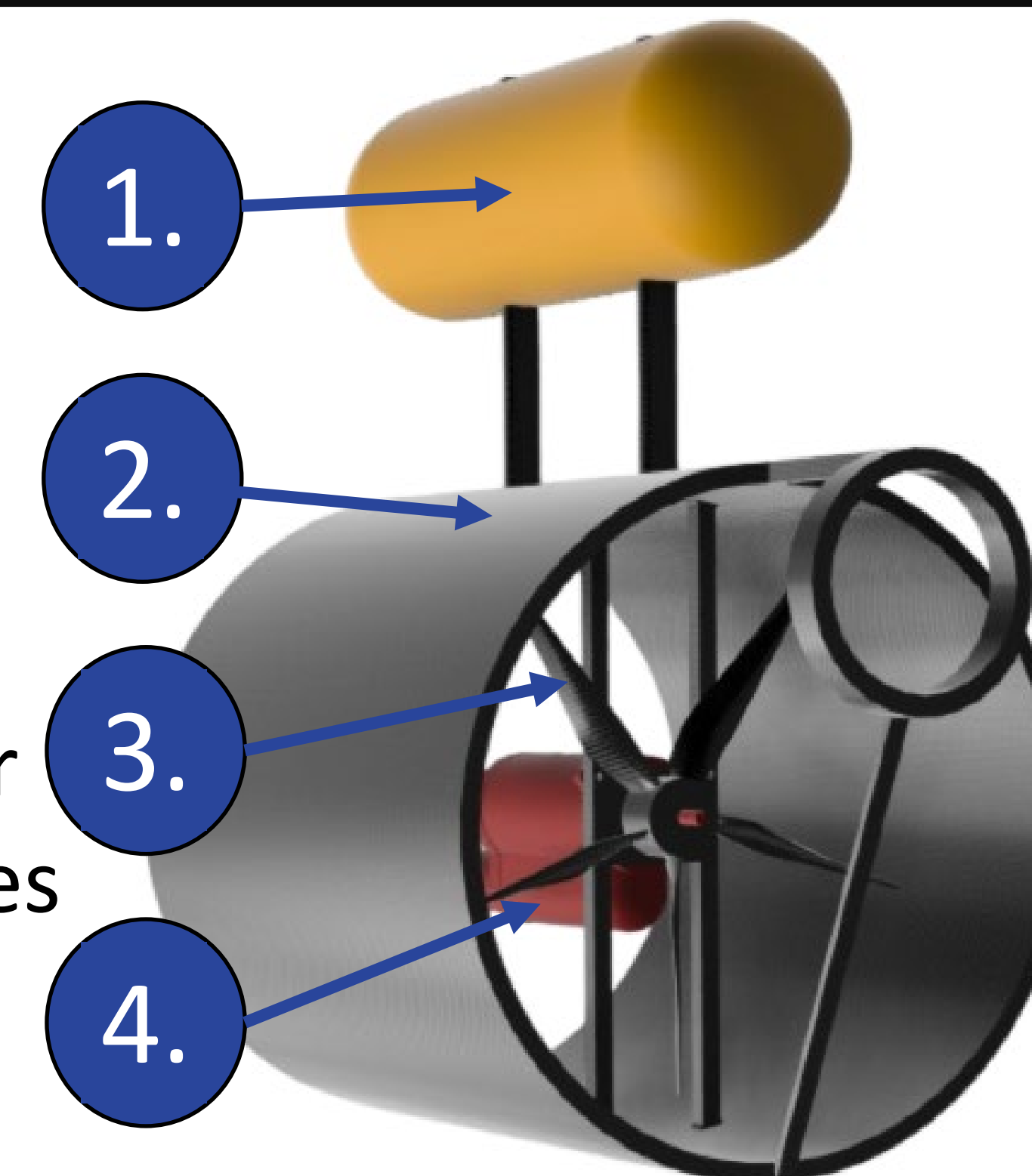


Figure 1: Turbine System CAD Assembly

### Foil Comparison:

NACA 4415	NACA 63-618
Sturdier Design	Streamlined Design
Moderate Lift and Drag	High Lift but Lower Drag
Easier Start-up	Larger Width
Efficient at Low Velocity	Efficient at High Velocity

## System Manufacturing

### Blades and Blade Hub:

1. Resin print with Siraya Tech Sculpt Clear
2. Lay 1.5 oz fiberglass and cure
3. Apply epoxy resin for additional strength

### System Housing:

1. Construct chicken wire frame around the Starboard subframe
2. Wrap 6 oz fiberglass cloth around outside
3. Apply West Systems 206 slow-cure epoxy

### Float:

1. 3D print separate hollow pill shape pieces
2. Fill with big gap filler spray foam
3. Glue together

### Electrical Components:

Brushless motor, bridge rectifier, potentiometer, watt meter, and amp meter

## Results

Table 1: Pulling Force Calculations

Number of Buckets	Weight (lbm.)	Number of Pulleys	Pulling Force (lbf.)
1	125	20	6.25
2	250	20	12.5
4	500	20	25

NACA Foil Velocities

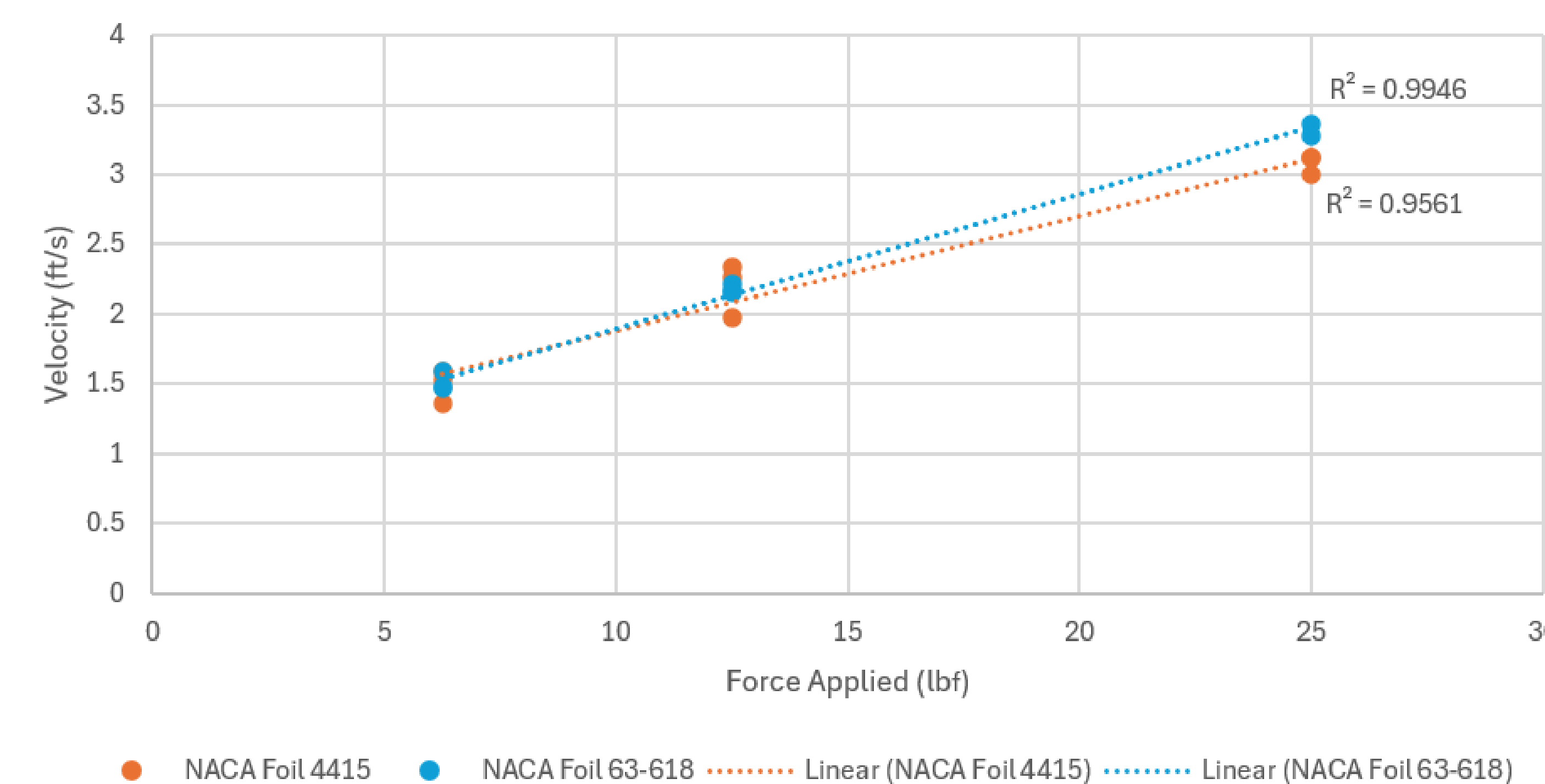


Figure 2: NACA Foil Velocity Results for Applied Force

## Future Considerations

**Blades:** More robust and smoother blades, internal spars for strength, force element analysis

**Housing:** Rigid mold or outer shell

**Gearbox:** Fully machined steel

**Electronics:** Motor with a lower KV Value

**Experiment:** CFD models, marine mammal protection

## Conclusion

Current Capture is a diverse project requiring skills and research in mechanical design and manufacturing, coastal engineering calculations and considerations, electrical and energy knowledge, composites and materials research, and core concepts from ocean engineering. The continuation of this project can yield breakthroughs for the offshore energy sector and the future of the maritime shipping industry.